Prepared by Robert E. Denton

Spruce Budworm

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SPRUCE BUDWORM CONDITIONS IN THE NORTHERN ROCKY MOUNTAINS 1952

Forest Insect Laboratory
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1952[1]/

INTRODUCTION

The spruce budworm, Choristoneura fumiferana (Clem.), is the most destructive and widespread defoliator in the northern Rocky Mountains. No Douglas-fir area in the region is entirely free of this insect, although its status is endemic over many national forests and adjacent timbered areas west of the Continental Divide.

Budworm outbreaks in the northern Rockies have been reported frequently beginning in the early 1920's and, until recent years, epidemics were confined mostly to scattered, localized areas. Since 1949, however, nearly all of the existing infestations in this region have increased in area and intensity at the rate of several hundred thousand acres each year. The concern of forest owners and managers as to possible consequences of the epidemics, as well as interest of the general public in the budworm, has increased greatly.

To date control by aerial spraying of DDT has been conducted only in one relatively small area on the Bitterroot National Forest, Montana. The purpose of this project was not only to prevent further budworm-caused tree mortality, but to test the feasibility of knocking down a heavy center of population without attempting to control the total area of infestation. Apparently good results were obtained in the sprayed portion. The area will be kept under close surveillance during coming seasons to determine the overall effectiveness of the project.

In 1952 it was imperative to obtain an accurate knowledge of existing budworm conditions throughout the region because of the possibility of conducting further control operations in the future. Due to the vast extent of current epidemics, an initial aerial reconnaissance survey was made in July to map the areas of visible defoliation in all fir forests in northern Idaho and Montana. This was followed by ground checks of all infested areas. Appraisal surveys of severely defoliated forests were made where control measures might be considered advisable. Data obtained from these surveys are combined into the present report by generalized national forest areas.

To simplify the classification of budworm-caused damage the cumulative amount of defoliation was divided into 3 categories: heavy, moderate, and light. Generally speaking, defoliation, or damage, was classed as heavy when tree mortality was noted, or when it appeared imminent as evidenced by tree top

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1/ Prepared by Robert E. Denton, Entomologist

killing. In the case of the smaller trees, usually this condition resulted after the 3rd or 4th year of heavy budworm feeding. When the tops of trees were stripped of all foliage, but not yet dead or stag-headed, damage was classed as moderate (with smaller trees, after 3 years of heavy feeding). Damage was classified as light when defoliation amounted to the loss of up to 2 year's growth, usually by which time the leader and 1 or 2 uppermost lateral whorls were stripped of their foliage.

On the whole this classification proved applicable during a major portion of the 1952 survey. As presented it applies only to trees of a certain size class; however, necessary refinements will be presented in a later report analyzing budworm conditions in this region.

REGIONAL SUMMARY

In 1952 budworm conditions in the northern Rocky Mountains were characterized by 1) a widespread increase in area of most existing infestations, 2) extensive tree damage along the eastern slope of the Continental Divide in central Montana, 3) an apparently complete decline of the 10-year outbreak in the South Fork Flathead River Primitive Area, Montana, and 4) a similar disappearance of an infestation in Engelmann spruce in Glacier National Park, Montana.

The occurrence of budworm infestations throughout the region in 1952 and a comparison with 1951 conditions is shown in Table 1. The total infested acreage in 1952 was 1,901,050 compared with 1,166,000 in 1951, or an increase of 735,050 acres. Nine national forests and 1 national park are included in the total infested acreage, however, several hundred thousand acres of fir forests are infested likewise on other than federal land (Figures 1 and 2).

Budworm damage in northern Idaho covered 268,440 acres, of which 243,160 acres was classed as light, 8,400 acres as moderate, and 16,880 acres as heavy. In Montana budworm damage extended over 1,632,610 acres, 1,453,310 acres of which were classed as light, 64,170 acres as moderate, and 115,130 acres as heavy damage.

Each year since 1949 budworm infestations in the northern Rockies have shown a great increase in both area and intensity. As yet relatively few forests have sustained serious damage due to the budworm's habit of feeding only on foliage of the current year. However, in the centers of several infested areas the year 1952 marked the 3rd and 4th years or more of heavy feeding. The effects of this are visible as a decided lack of foliage on the larger trees in the overstory, top killing on intermediate trees, and the death of smaller trees in the understory.

Table 1. Acreage of 1952 spruce budworm infestations and a comparison with 1951 conditions, northern Rocky Mountains.

Area	Total Acreage		Degree of Damage - 1952		
	1951	1952	Light	Moderate	Heavy
IDAHO					
Nezperce Nat'l. For.	20,500	58,620	43,260	4,860	10,500
Craig Mtn. (Waha, Ida.)	9,200	129,440	126,440	2,000	1,000
Lolo Nat'l. For. (Powell District)	23,700	80,380	73,460	1,540	5,380
Sub-Totals	53,400	268,440	243,160	8,400	16,880
MONTANA					
Lolo Nat'l. For. (Bonita District)	1,600	47,360	47,360		
Bitterroot Nat'l. For.	12,000	111,140	111,140		
Garnet Range	30,000	162,120	162,120		
Flathead Nat'l. For.	235,000	23,320	22,270	550	500
Helena Nat'l. For.	530,000	583,040	462,810	46,300	73,930
Deerlodge Nat'l. For.	120,000	297,480	249,770	12,710	35,000
Beaverhead Nat'l. For.	Unknown	17,560	12,000	2,080	3,480
Gallatin Nat'l. For.	80,000	180,080	180,080		
Yellowstone Nat'l. Park	3,000	15,720	15,720		
Lewis & Clark Nat'l. For.	100,000	194,790	190,040	2,530	2,220
Glacier Nat'l. Park	1,000	Declined			
Sub-Totals	1,112,600	1,632,610	1,453,310	64,170	115,130
Totals	1,166,000	1,901,050	1,696,470	72,570	132,010

NEZPERCE NATIONAL FOREST, IDAHO

For the past 6 years a budworm outbreak has existed on the Salmon River District west of Riggins, Idaho. Due to fluctuations in intensity of the infestation from year to year only a small amount of mortality has occurred in the past. In 1952, however, the infested acreage more than doubled that of 1951, totalling over 58,000 acres. Similarly, the amount of damage to Douglas-fir and white fir has increased considerably.

Two centers of heavy damage were mapped in Bean Creek and Papoose Creek drainages. In the former drainage top killing of intermediate trees and mortality of smaller trees extended over nearly 7,000 acres. An additional

3,000 acres were classed as having moderate damage where the tops of trees have been stripped but were not yet dead. In the latter drainage trees in the understory have suffered heavy damage over nearly 4,000 acres, with moderate damage occurring over an additional 2,000 acres.

On the remainder of the forest evidence of a very light budworm population was found as far north as Grangeville. As yet the amount of damage has been insignificant on districts other than the Salmon River.

East of the Little Salmon River, on the Payette National Forest in Region 4, budworm infestations were observed in Shorts Creek and Hay Creek. Limited observations indicated that light damage extended over approximately 6,000 acres of Douglas-fir and white fir type.

CRAIG MOUNTAIN AREA, IDAHO

An outbreak similar to that on the Nezperce National Forest has been in progress south of Lewiston, Idaho for at least 6 years. In 1952 the visible area of defoliation has spread through all fir forests to as far south as the Salmon River and east to the Camas Prairie. This amounts to approximately 130,000 acres, none of which is within any national forest.

Much of the forest is comprised of old and second-growth ponderosa pine with Douglas-fir and grand fir occupying an intermediate position. In many areas the understory is chiefly fir species.

As may be seen in Table 1 light damage, amounting to the loss of 1 or 2 years of foliage, extended over 126,000 acres of forested land. Heavy and moderate tree damage was observed over 1,000 and 2,000 acres, respectively, in the vicinity of Waha. Here heavy budworm feeding for the past 4 years has resulted in the death or top killing of a large percentage of trees. In general the intensity of the infestation has increased considerably since 1951.

LOLO NATIONAL FOREST, IDAHO AND MONTANA

Powell District

The most recent budworm outbreak on this district began in 1949 and has more than doubled in acreage each year since then. In 1952 the infestation reached a level nearly 4 times that of 1951, eventually spreading over 80,380 acres.

The heaviest defoliation has been confined to 5,380 acres in the Cabin Creek and Haskell Creek drainages. In both areas alpine fir has suffered much more damage than has Douglas-fir. Engelmann spruce has been fed upon only slightly. In Cabin Creek some alpine fir reproduction has been killed as well as up to 6 feet of the tops of larger alpine fir trees. Douglas-fir tops have been stripped, but they are not generally stag-headed as yet. In Haskell Creek Douglas-fir has suffered relatively little damage compared to alpine fir.

Damage to the 3 principle host species mentioned above has been light over the remaining 75,000 acres, except for about 1,000 acres along Colt Creek where the tops of fir trees have been stripped but were not yet dead.

Bonita District

In 1951 a new outbreak covering 1,600 acres was reported in Harvey Creek, west of Drummond, Montana. In 1952 the aerial survey showed this area to have increased to 47,360 acres. Subsequent ground checks showed that cumulative damage was light, although defoliation of the current year's growth was almost complete.

BITTERROOT NATIONAL FOREST, MONTANA

Sula District

Preparatory to the 12,000-acre budworm control project conducted in June of this year on the East Fork Bitterroot River, an intensive ground survey determined a total infested area of 89,000 acres on the Sula District. An increase in intensity of the infestation surrounding the heavy center has occurred in 1952, as determined by the fact that as high as 20 per cent of the new growth buds on both Douglas-fir and white fir were infested with larvae but virtually no 1951 defoliation was observed. Although much of this increase probably could be attributed to a spread of the budworm during the 1951 moth flight, other evidence indicated an "in place" buildup of budworm populations over the forest in 1952. Evidence of the budworm was commonly found throughout the eastern slopes of the Bitterroot valley.

In 1952 the area of visible defoliation totalled 77,340 acres in addition to the 12,000 acres that were sprayed. It is hoped that before budworm populations can build up to truly epidemic numbers over the remaining acreage that natural control factors will reduce the infestation to an endemic level.

West Fork District

Another infestation covering 33,800 acres of Douglas-fir and white fir forest was mapped on the West Fork Bitterroot River south of Alta. This infestation was similar in intensity to that in the East Fork except that it was apparently a year younger. Light damage consisting of 2 years of defoliation was observed over most of the outbreak area, with some areas of smaller trees being on the borderline between light and moderate damage. As found in the Sula District, very light budworm populations existed in fir stands surrounding the main infestation.

GARNET RANGE, MONTANA

A very noticeable increase in infested area was observed in the Garnet Range north and east of Drummond, Montana. In reality, this appeared to be part of an extension of the outbreak along the Continental Divide that was reported spreading westward in 1951. Whereas defoliation extended over 30,000 acres in that year, in 1952 the figure reached approximately 162,000 acres.

An idea of the increase in population densities that have accompanied the upward trend of the budworm can be gained by the following illustration. In several instances, although no sign of the budworm presence has been observed in past years, defoliation of the current growth amounted to nearly 100 per cent over extensive areas of Douglas-fir type many miles west of the 1951 limits of infestation. As yet, however, the cumulative amount of damage to the trees has been light.

FLATHEAD NATIONAL FOREST, MONTANA

South Fork Primitive Area

The 10-year budworm epidemic in the South Fork Primitive Area has declined steadily since 1950, and no visible defoliation was detected from the air during the past 2 years. Ground checks in 1951 showed that the budworm could still be found easily upon closer examination but in 1952 only an occasional insect was seen. Apparently the budworm is approaching an endemic status in this area.

Swan Valley

During the past 7 years the budworm has spread more or less throughout the Swan Valley. However, in 1952 visible defoliation was limited to a total of 21,960 acres in the Soup Creek, Goat Creek, and Woodward Creek drainages.

From all indications the budworm has had difficulty maintaining itself over much of the area and its spread has been slow. This is probably due to a mixed forest type of larch, pine, and fir. For many years damage amounted only to partial defoliation of new growth fir terminals and the trees have been able to survive repeated attacks.

Since 1950 the population density has increased somewhat, but, even so, in 1952 heavy damage extended over only 500 acres with moderate damage over an additional 550 acres. To date considerably more damage has been done to white fir in these areas than to Douglas-fir. In Soup Creek some white fir trees up to 14 inches in diameter have been killed and many more left stag-headed. Smaller Douglas-fir trees have been top-killed and larger trees have suffered the loss of much foliage. Over the remaining 20,910 acres the amount of damage has been light.

Echo Guard Station

In 1952 a new outbreak was reported in the vicinity of Echo Guard Station, southeast of Kalispell, Montana; subsequent surveys indicated that the infestation began in 1951. Light damage, amounting to partial defoliation of the current and last year's growth was mapped over 1,360 acres.

HELENA NATIONAL FOREST, MONTANA

Nowhere in the region have budworm outbreaks been more widespread or damaging than those on the Helena National Forest, especially along the eastern slope of the Continental Divide. The 1952 survey showed an infested area of approximately 583,000 acres of Douglas-fir type, where trees on nearly 74,000 acres have sustained heavy damage and those on more than 46,000 acres moderate damage (Table 1).

Heaviest damage was noted in the vicinity of Marysville (25 miles northwest of Helena) and from Lump Gulch south beyond the town of Boulder. The epidemic in the Big Belt Mountain Range, which showed a decline in several areas in 1951, has increased somewhat in 1952. A breakdown of the total infested acreage is presented in Table 2.

Table 2. Acreage of spruce budworm infestations by degree of damage on the Helena National Forest - 1952.

Area	Degree of Damage			Total
	Light	Moderate	Heavy	
Continental Divide (West Slope)	83,730			83,730
Continental Divide (East Slope)	117,930	35,050	73,930	226,910
Big Belt Mountain Range	227,350	11,250		238,600
Dry Range	33,800			33,800
Totals	462,810	46,300	73,930	583,040

Continental Divide (West Slope)

Most of the epidemic west of the Continental Divide has been in progress for 2 years. Heavy defoliation of the current year's growth was observed throughout 83,730 acres, although cumulative damage has been light as yet.

Continental Divide (East Slope)

North of McDonald Pass population densities appeared somewhat less in 1952 than in 1951; nevertheless current defoliation generally was heavy. Top-killing and tree mortality were evident in young, dense, even-aged stands of Douglas-fir around Marysville and in Little Prickly Pear Creek.

South of Helena damage was classified as light as far as Lump Gulch, where it increased to heavy. Likewise, heavy damage was found in Clancy Creek and Comet Creek where extensive top killing and mortality of smaller Douglas-fir trees has occurred.

Big Belt Mountain Range

Budworm outbreaks, characterized by considerable fluctuations in intensities, have persisted on one portion or another of the Big Belt Mountain Range for many years. In a few drainages from individual trees to stands covering entire mountainsides have been killed.

In general, an increase in intensity of the infestation was noted in 1952 although recent damage has been light over 227,350 acres and moderate over a total of 11,250 acres in the Magpie Creek and Deep Creek drainages.

DEERLODGE NATIONAL FOREST, MONTANA

A widespread increase in the area of budworm outbreaks was found in 1952 on the Deerlodge National Forest. As may be seen in Table 1, defoliation extended over 297,480 acres, compared to 120,000 acres in 1951.

Heavy damage, similar to that on the Helena National Forest, was observed in the vicinity of Boulder, Montana, including the drainages of Whitetail Creek, Little Boulder River, McCarthy Creek, and Muskrat Creek. Moderate damage extended over a total of 12,710 acres in adjacent areas; elsewhere light damage covered 249,770 acres as shown in Table 3.

Table 3. Acreage of spruce budworm infestations by degree of damage on the Deerlodge National Forest - 1952.

District	Degree of Damage			Total
	Light	Moderate	Heavy	
Philipsburg	75,830			75,830
Deerlodge	49,150			49,150
Butte	43,570			43,570
Boulder	23,040	5,800	35,000	63,840
Whitehall	58,180	6,910		
Totals	249,770	12,710	35,000	297,480

BEAVERHEAD NATIONAL FOREST, MONTANA

In 1952 a previously unreported budworm infestation was discovered in Douglas-fir stands immediately south of Virginia City, Montana. The total area of visible defoliation covered 17,560 acres, of which all but 1,000 acres was outside the national forest boundary. Top-killing of trees, denoting heavy damage, extended over 3,480 acres and moderate damage over 2,080 acres. The remaining Douglas-fir on 12,000 acres has suffered only light damage.

GALLATIN NATIONAL FOREST, MONTANA

Budworm conditions on the Gallatin National Forest in 1952 were characterized by 1) a great increase in infested area in the Bridger Range, 2) the disappearance of a 15,000-acre infestation along the north slope of the Gallatin Range, and 3) new outbreaks on the Gardiner District. A summary of budworm conditions on the forest is shown in Table 4.

Table 4. Acreage of spruce budworm infestations by degree of damage on the Gallatin National Forest - 1952.

Area	Degree of Damage			Total
	Light	Moderate	Heavy	
Bridger Range	147,820			147,820
Horseshoe Range	12,540			12,540
Gallatin Range	Declined			--
Gardiner District	19,720			19,720
Totals	180,080			180,080

The greatest spread of the budworm on this forest was noted in the Bridger Range where the total acreage of visible defoliation has increased from 50,000 to 147,820 in the period 1951-1952. As yet the amount of damage to Douglas-fir trees has been light.

An outbreak covering 15,000 acres along the northern face of the Gallatin Mountain Range declined in 1952. Although the budworm was still relatively easy to find, the amount of defoliation was insufficient to result in visible damage.

The budworm outbreak on the Gardiner District totalled 19,720 acres in 1952, compared to 7,000 acres in 1951. Since it has been in progress only for 2 years the amount of damage has been light.

YELLOWSTONE NATIONAL PARK, MONTANA AND WYOMING

In 1951 a budworm outbreak covering 3,000 acres of Douglas-fir type was discovered along the northern Park boundary in Reese Creek and Stevens Creek drainages. The 1952 aerial survey showed additional areas of defoliation at Undine Falls and along the Yellowstone River, giving a total infestation of 15,720 acres (Table 5).

Although the damage has been light, concern has been registered by Park officials in the case of the infestation at Undine Falls which borders a heavily-travelled highway. From an aesthetic standpoint an unsightly condition has resulted from heavy budworm feeding on the current year's growth.

Table 5. Acreage of spruce budworm infestations by degree of damage in Yellowstone National Park - 1952.

Area	Degree of Damage			Total
	Light	Moderate	Heavy	
Electric Peak	6,220			6,220
Undine Falls	2,330			2,330
Yellowstone River	7,170			7,170
Totals	15,720			15,720

LEWIS AND CLARK NATIONAL FOREST, MONTANA

In 1952 the budworm was spread over a total of 194,790 acres in the Little Belt Mountain Range, the Castle Mountains, and the Crazy Mountains.

Approximately 149,470 acres of Douglas-fir forests along the southern border of the Little Belt Mountain Range have suffered light to moderate damage.

Further south, in the Castle Mountains, the amount of damage was classed as light on 32,680 acres, moderate on 2,530 acres, and heavy on 2,220 acres.

A new infestation was discovered in 1952 along the northwest face of the Crazy Mountains. Visible defoliation covered 7,890 acres of Douglas-fir forest; to date the amount of damage has been insignificant.

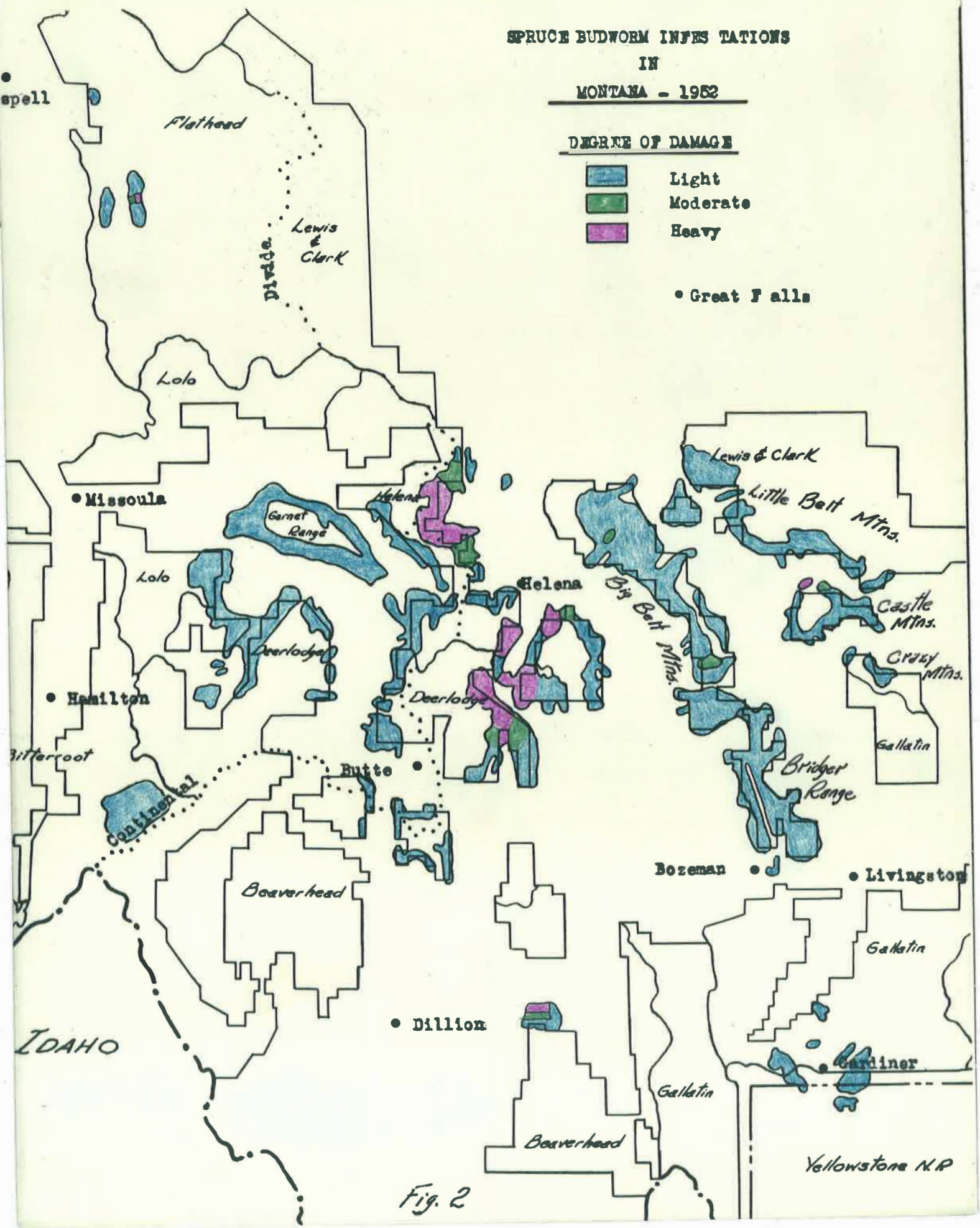
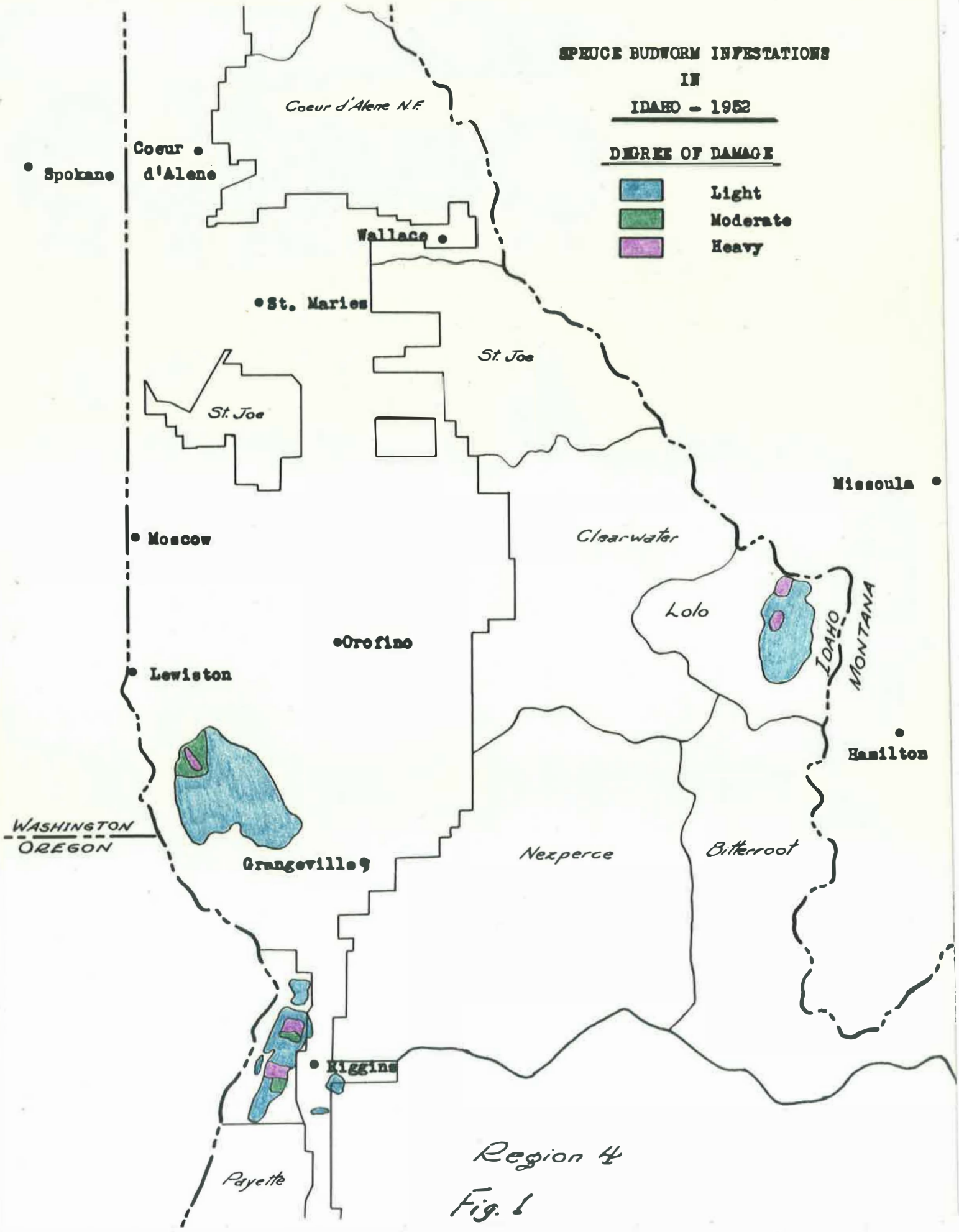

SPRUCE BUDWORM INFESTATIONS
IN
MONTANA - 1952
DEGREE OF DAMAGE
Light
Moderate
Heavy
Great Falls
Missoula
Hamilton
Butte
Helena
Deerlodge
Dillon
Bozeman
Livingston
Gardiner
Flathead
Lewis & Clark
Divide
Lolo
Garnet Range
Big Belt Mts.
Little Belt Mts.
Castle Mtns.
Crazy Mtns.
Gallatin
Bridger Range
Bitterroot
Continental
Beaverhead
IDAHO
Yellowstone N.P.

Fig. 2


SPRUCE BUDWORM INFESTATIONS
IN
IDAHO - 1952
DEGREE OF DAMAGE
Light
Moderate
Heavy
Coeur d'Alene N.F.
Coeur d'Alene
Spokane
Wallace
St. Maries
St. Joe
St. Joe
Missoula
Moscow
Clearwater
Lolo
IDAHO
MONTANA
Orofino
Lewiston
Hamilton
WASHINGTON
OREGON
Grangeville
Nezperce
Bitterroot
Riggins
Payette
Region 4
Fig. 1